

Hassayampa Landscape Restoration Environmental Assessment

Aquatics Resources Report

Prepared by:

Albert Sillas
Fishery Biologist
Prescott National Forest

for:

Bradshaw Ranger District
Prescott National Forest

October 2019

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer and lender.

Table of Contents

Introduction	1
Relevant Laws, Regulations, and Policy	1
Regulatory Framework	1
Topics and Issues Addressed in This Analysis	4
Resource Concerns	4
Resource Indicators and Measures	4
Methodology	5
Information Sources	5
Incomplete and Unavailable Information	5
Spatial and Temporal Context for Effects Analysis	5
Affected Environment	6
Existing Condition	6
Existing Conditions for Resource Indicators and Measures	9
Species Identification	11
Environmental Consequences	17
Alternative 1—No Action	17
Alternative 2—Proposed Action	18
Summary of Effects	29
References Cited	31
Appendix A: Resource Protection Measures	33
Appendix B: Federally Listed Plants and Animals (April 2016)	35
Appendix C: Regional Forester’s Sensitive Animal and Plant Species (April 2016)	36
Appendix D: Species Excluded from Detailed Analysis	37

Tables

Table 1. Resource indicators and measures for assessing effects	4
Table 2. Potential natural vegetation types present in the project area, including non-National Forest System lands	6
Table 3. Sixth-field HUC watersheds and status carried forward in analysis for the Hassayampa Project ..	7
Table 4. Perennial/Intermittent stream miles located within the Hassayampa Project	9
Table 5. Erosion hazard acreage by potential natural vegetation type within the Hassayampa Project area	10
Table 6. Species identified for the Hassayampa Project	11
Table 7. Resource indicators and measures for alternative 2 direct/indirect effects	18
Table 8. Resource indicators and measures for Alternative 2 cumulative effects	26
Table 9. Summary comparison of environmental effects to Aquatic Resources	29
Table 10. Determination of effects for Federally listed species and Forest Service Region 3 Sensitive Species	30

Figures

Figure 1. Watersheds associated with the Hassayampa Landscape Restoration Project	8
Figure 2. Goodwin Fire Burn Severity Map – Grapevine Botanical Area	13
Figure 3. Slope Class and Erosion Hazard Ratings – Grapevine Botanical Area	14
Figure 4. Upper Grapevine Creek Watershed PNVNT and Treatment map	22

Introduction

The purpose of this report is to document the effects of the proposed action and the no-action alternatives of the Hassayampa Landscape Restoration Project on aquatic resources within the project area. This report serves as the biological evaluation that documents the effects on federally listed species and critical habitat under Endangered Species Act and on Forest Service Region 3 Regional Forester's Sensitive Species for the Prescott National Forest (the Forest).

Federally listed species and/or suitable habitat present in the Hassayampa project area or that the project potentially affects includes the Gila trout. There is no designated critical habitat for the Gila trout. Consultation with the U.S. Fish and Wildlife Service is required for projects that may impact federally listed species or critical habitat under the Endangered Species Act. A separate biological assessment will be completed for consultation on the selected alternative. Three Forest Service sensitive species also occur in the project area; these are the desert sucker, lowland leopard frog, and Verde Rim springsnail.

This report was developed after considering the best available science for assessing resource conditions and then determining the ecological effects associated with project activities.

Relevant Laws, Regulations, and Policy

Regulatory Framework

Land and Resource Management Plan

The Prescott National Forest Land and Resource Management Plan (Forest Plan) provides standards and guidelines for aquatic wildlife and hydrology and watershed resources that would mitigate impacts to aquatic species and their habitat (USDA Forest Service 2015). The relevant standard and guidelines are listed below.

Aquatic Wildlife Standards and Guidelines, Forest Plan, page 79

- Guide-Fish/Aquatics-1: Habitat management objectives and aquatic/riparian species protection measures from approved recovery plans should be applied to activities and special uses occurring within federally listed species habitat.
- Guide-Fish/ Aquatics-2: Design features, mitigation, and project timing considerations should be incorporated into ground-disturbing projects that may affect Southwestern Region sensitive species' occupied habitat near streams, seeps, and springs. Examples include undisturbed areas, timing restrictions, adjusted intensity of use, and avoiding use of large equipment.

Watersheds Standards and Guidelines, Forest Plan pages, 72–73

- Standard-WS-1: Construction or maintenance equipment service areas shall be located at least 100 feet from the edges of all riparian corridors, seeps, and springs to prevent gas, oil, or other contaminants from washing or leaching into aquatic and riparian habitats.
- Standard-WS-3: Containment measures shall be employed within 100 feet from the edge of all riparian corridors, seeps, and springs for storage of fuels and other toxicants to prevent degradation of water quality and aquatic habitat.
- Guide-WS-1: Ground-disturbing projects should not alter the long-term hydrologic regime within 6th level hydrologic units (subwatersheds). The long-term hydrologic effects analysis should

evaluate level of disturbance, type of activity, and soil, geologic, and streamflow characteristics and expected recovery periods.

- Guide-WS-3: Riparian-dependent resources should be managed to maintain and improve productivity and diversity of riparian-dependent species. Riparian communities should provide for the sustainability of aquatic and riparian species.
- Guide-WS-4: Adverse impacts to stream channel features (e.g., streambanks, obligate riparian vegetation) should be minimized by modifying management actions. Examples of modification could include, but are not limited to: adjusting timing and season of grazing, limiting use and location of heavy machinery, or avoiding placing trails or other recreation structures where recreation use could negatively affect stream channel features.
- Guide-WS-5: Ground cover sufficient to filter runoff and prevent erosion should be retained in riparian corridors, seeps, and springs.
- Guide-WS-8: Operation of heavy equipment, such as dozers, backhoes, or vehicles, in stream channels, seeps, and springs should be avoided. If use of equipment in such areas is required, site-specific design features should be implemented to minimize disturbance to soil and vegetation. Restoration or stabilization should occur immediately following disturbance.

Desired Condition

The following conditions are desired to assist with the protection of aquatic wildlife species and their associated habitats, and to increase the resilience and adaptive capacity of these species and habitats to accommodate expected changes imposed by future climate trends for the Southwest. Aquatic desired conditions were developed for the Forest Plan (see page 45).

DC-Aquatic-1

- Streams, springs, and wetlands that have potential to support native fish and/or other aquatic species provide quality and quantity of aquatic habitat within the natural range of variability.
- Quantity and timing of water flows are maintained in streams, groundwater dependent ecosystems, and wetlands to retain or enhance aquatic habitat and ecological functions.
- Water quality is sustained at a level that retains the biological, physical, and chemical integrity of the aquatic systems and benefits survival, growth, reproduction, and migration of native aquatic species.
- Riparian vegetative communities within these aquatic habitats are intact and functioning.
- Aquatic habitats are free of or minimally impacted by non-native plant and animal species.

DC-Aquatic-2

- Desired non-native fish species are present only where recreational fishing opportunities are emphasized.

DC-Aquatic-3

- Ecological conditions provide habitat for associated federally listed species. Habitat conditions generally contribute to survival and recovery, and contribute to the delisting of species under the Endangered Species Act of 1973 (P.L. 93-205).
- Improved aquatic and riparian habitats for candidate and proposed species help preclude species listings as threatened or endangered under Endangered Species Act.

Special Area Designations

The 771-acre Grapevine Botanical Area was designated by the Forest in 1997. This area encompasses the headwaters of the perennial Grapevine Creek and associated upland and riparian vegetation. The area represents a unique resource on the Forest located within the Crown King Management Area. The following desired future condition and standards apply to this area. This area is occupied habitat for the Gila trout (Endangered Species Act threatened) and for the Verde Rim springsnail (Forest Service sensitive).

Desired Condition for the Grapevine Botanical Area (DC-CK-MA-3, Forest Plan, page 104)

The area in and around the Grapevine Botanical Area provides a non-motorized setting for recreation. Within the Grapevine Botanical Area, Grapevine Creek and riparian areas are healthy, the watershed is properly functioning, and sensitive plant and animal species are protected. The unique botanical characteristics that make the area valuable for scientific research are protected and maintained.

Crown King Management Area Standard 1, Forest Plan, page 104

Within the Grapevine Botanical Area:

- No livestock grazing, trailing, or driving shall take place within the botanical area except that livestock may trail through the Bootlegger-Grapevine Unit on established roads to Forest Road 87A and then Trail 304. This movement shall be controlled and not be accomplished by drifting.
- Motorized or mountain bike use shall not take place on Trails 4, 304, and 9432 below the rim of Big Bug Mesa.
- Recreation use shall be limited to day use.

Federal Law

Endangered Species Act

Endangered Species Act section 7(d) requires that Federal agencies “shall not make any irreversible or irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would not violate subsection (a)(2).” This project would not make irreversible or irretrievable commitments and the status quo will be maintained during the consultation process.

Critical Habitat Unit

Critical habitat is a term defined and used in the Endangered Species Act. It is a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. There is no designated or proposed critical habitat in the project area or outside the project boundaries that could be affected by the project.

Topics and Issues Addressed in This Analysis

Resource Concerns

Concerns about proposed vegetation treatments along Grapevine Creek with occupied habitat for Gila trout were brought up by the U.S. Fish and Wildlife Service and Arizona Game and Fish Department. Comments centered on maintaining adequate riparian/stream shade for water temperatures and mitigating treatments to reduce sedimentation effects to Grapevine Creek. The various resources protection measures identified for the proposed action address these concerns, and will be addressed in the analysis within this report.

Resource Indicators and Measures

The Hassayampa Project proposes to reduce fuels and restore fire as an ecological process. Opportunities for treatments are proposed in a variety of potential natural vegetation types. Methods to be used to reduce fuels and create and maintain healthy and resilient ecosystems include hand thinning or pruning, prescribed burning, and mechanized and non-mechanized fuel reduction treatments. Roadwork and fire line construction would be conducted to support these activities. The proposed treatments could have potential impacts to aquatic species and their habitats in the project area. Project-related impacts of main concern to aquatic resources are sedimentation that can decrease aquatic habitat quality and quantity, and vegetation treatments in stream management zones that can affect water quality. The spatial scale to be used for analysis are the 6th-field Hydrologic Unit Code (HUC) and the stream management zone¹ that are related to aquatic resources. Throughout this report, the term “6th-field HUC” or “6th-field watershed” is used. These interchangeable terms refer to watersheds of a specific size, which, on average, are generally 40 square miles or approximately 25,600 acres. They generally contain one or more smaller drainages.

The following two indicators and measures listed in Table 1 will be used to compare alternatives for the Hassayampa Project.

Table 1. Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Measure	Used to Address: Purpose/Need, or Key Issue?	Source
Aquatic habitat quantity and water quality	Sediment delivery	Total proposed vegetation treatments within select 6 th -field HUC watersheds	No	State Water Quality Standards, Forest Plan
Aquatic/riparian habitat, water quality	Water temperature	Total proposed vegetation treatments within 100 foot stream management zone of perennial/intermittent streams of select 6 th -field HUC watersheds	No	State Water Quality Standards, Forest Plan

¹ The streamside management zone is an area or strip of land adjacent to a stream or other body of water where management practices are planned and implemented in a manner that protects water quality, aquatic wildlife and wildlife habitat. Trees and vegetation within the streamside management zone serve as a natural filter to keep sediment out of a stream, reduce soil erosion, and buffer the stream from damage caused by nearby management activities such as harvesting of timber, vegetation treatment, and road construction or prescribed burning. The streamside management zone is not a zone of exclusion where all activities are precluded, but because of the need to protect water quality and other values, the zone is an area where activities should be carefully managed.

Methodology

The analysis of effects to aquatic species and their habitat evaluates direct, indirect, and cumulative effects for the no-action and proposed-action alternatives. Analysis is based on the aquatic resource measures related to the total amount of proposed vegetation treatments in 6th-field HUC watersheds and also within stream management zones in the project area. Existing conditions and effects analysis from the Soils and Hydrology reports (available in the project record) were reviewed to help quantify effects to aquatic resources. An important consideration to potential effects is the erosion hazard of potential natural vegetation types in the project area watersheds.

Resource protection measures, including best management practices, site-specific mitigations, and Forest Plan standards and guidelines are incorporated into the development of the proposed action. By incorporating these resource protection measures and best management practices, it is believed that substantial conflicts with soil and hydrologic resources would be avoided, and potential impacts would be either eliminated or mitigated so that effects are within acceptable levels. The full list of resource protection measures are provided in the environmental assessment. Specific resource protection measures relevant to this analysis are addressed in this section and listed in Appendix A of this document.

Information Sources

Effects of the proposed action to aquatic resources in the project area is taken from various published sources on fire effects and fuels management (Elliot et al. 2010; Gresswell 1999; Parker 2006; Pilliod et al. 2003). In addition, information on the existing watershed and soil conditions and the potential effects to these resources from the alternatives was taken from the Hydrology report (Hermendorfer 2017) and Soils report (Burgoyne 2017).

Incomplete and Unavailable Information

Only general information on aquatic resources within the Hassayampa Project area are available such as 6th-field HUC watershed area and ownership, perennial stream miles, aquatic species surveys, and water quality data. Stream habitat inventories have not been completed within the Hassayampa Project area. There are some limited riparian assessment for streams in the project area.

Spatial and Temporal Context for Effects Analysis

Direct/Indirect Effects Boundaries

The spatial boundaries for analyzing the direct and indirect effects to aquatic species resources are the 6th-field HUC watersheds with perennial streams segments, because they provide suitable and/or occupied habitat for aquatic species addressed in this report. The temporal boundaries for analyzing the direct and indirect effects are 5 years for short-term effects from vegetation treatments (both mechanical and prescribed fire), and greater than 5 years for long-term effects, because of watershed response to treatments in the project area.

Cumulative Effects Boundaries

The spatial boundaries for analyzing the cumulative effects to aquatic species resources are the 21 6th-field HUC watersheds, because of potential effects to suitable and/or occupied habitat for aquatic species addressed in this report. The temporal boundaries for analyzing the cumulative effects are 5 years for short-term effects from vegetation treatments (both mechanical and prescribed fire), and greater than 5 years for long-term effects, because of watershed response to treatments in the project area.

Affected Environment

Existing Condition

The landscape within the Hassayampa Project area is quite varied in respect to slope, aspect, and elevation; the landscape is distinctly hilly. The elevation ranges from 7,979 feet to about 3,200 feet. Potential natural vegetation types found within the project area include Semi-Desert Grasslands, Juniper Grasslands, Piñon-Juniper Evergreen Shrub, Interior Chaparral, Ponderosa Pine-Evergreen Oak, Ponderosa Pine-Gamble Oak, Desert Communities, and Riparian Gallery Forest (Table 2). Interior chaparral vegetation makes up the majority (57 percent) of the project area.

Table 2. Potential natural vegetation types present in the project area, including non-National Forest System lands

Potential Natural Vegetation Types	Acres	Percent of Project Area
Desert Communities	246	0
Interior Chaparral	139,988	57
Juniper Grassland	10,679	4
Piñon-Juniper Evergreen Shrub	24,324	10
Ponderosa Pine-Evergreen Oak	11,363	5
Ponderosa Pine-Gambel Oak	17,425	7
Riparian Gallery	3,222	1
Semi-Desert Grassland	39,001	16
Totals	246,434	100

Information on water resources described below is summarized from the Hydrology specialist report. The project area lies within portions of 32 6th-field HUC watersheds, displayed in Figure 1. Only 21 of those 6th-field HUC watersheds where greater than 4 percent could be affected by proposed project activities are considered for analysis for aquatic resources (Table 3). This follows the rationale stated in the Hydrology specialist report.

In 2011 the Forest used the watershed classification and assessment tracking protocol to determine the health of its 6th-field HUCs. Watershed condition class in the Hassayampa Project area are mainly rated as “functioning at risk.” The definition for this rating is, “Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses.”

Past harvesting has occurred on approximately 4,260 acres across the project area with an additional 6,937 acres of mastication and 4,450 acres of non-mechanical treatments. Several wildfires and prescribed fires have occurred in the project area. Wildfires have occurred on approximately 75,678 acres within the project area and prescribed fire on 21,403 acres across the project area. There have been four major fires within the Hassayampa Project area in recent years. They include the 2017 Goodwin Fire (28,516 acres), 2012 Gladiator Fire (16,240 acres), 2013 Doce Fire (6,767 acres), and 2015 SA Hill Fire (4,336 acres).

Table 3. Sixth-field HUC watersheds and status carried forward in analysis for the Hassayampa Project

6th-Field HUC Watershed	6th-Field HUC Total Acres	Project Area Acres in 6th-Field HUC	Project % of 6th-Field HUC	Overall Watershed Condition Class
Bear Creek	12,028	12,033	100.0	Impaired Function
Big Bug Creek	38,326	18,203	47.5	Functioning at Risk
Blind Indian Creek	30,579	29,740	97.3	Functioning at Risk
Boulder Creek	25,399	2,069	8.1	Functioning Properly
Buzzard Roost Wash-Upper Hassayampa River	17,450	17,404	99.7	Functioning at Risk
Cedar Creek	8,251	8,255	100.0	Functioning at Risk
Chaparral Gulch-Agua Fria River	37,915	5,320	14.0	Functioning at Risk
Cherry Creek	7,464	6,566	88.0	Functioning at Risk
Crooks Canyon	11,978	11,983	100.0	Functioning at Risk
Groom Creek-Upper Hassayampa River	22,933	4,381	19.1	Functioning at Risk
Humbug Creek	43,102	11,949	27.7	Functioning at Risk
Lower Skull Valley Wash	37,985	12,286	32.3	Functioning at Risk
Lower Turkey Creek	13,340	8,272	62.0	Functioning at Risk
Milk Creek	25,420	22,722	89.4	Functioning at Risk
Minnehaha Creek	13,104	12,445	95.0	Functioning at Risk
Moore's Spring-Upper Hassayampa River	22,927	5,413	23.6	Functioning at Risk
Oak Creek	9,465	1,805	19.1	Functioning at Risk
Poland Creek	28,029	12,175	43.4	Functioning at Risk
Upper Skull Valley Wash	22,135	9,350	42.2	Functioning at Risk
Upper Turkey Creek	16,401	16,401	100.0	Functioning at Risk
Wolf Creek	12,576	12,582	100.0	Functioning at Risk

Perennial stream miles within the Hassayampa project area are limited to very short stretches of stream in a small number of the 6th-field HUC watersheds (Table 4.). This scarcity of perennial water thus limits the amount of aquatic habitat and aquatic species populations in the project area. The upper Hassayampa River has the most perennial stream miles at 11.7 miles associated with three 6th-field HUC watersheds. The Hassayampa River from the headwaters to the Copper Creek confluence (11 miles) is listed in the 2012/14 water quality report (Arizona Department of Environmental Quality 2015) as not attaining water quality standards to support designated uses for warm water aquatic and wildlife because of unacceptable levels of various metals and low pH due to mining operations. This impairment most likely contributes to the lack of fish and amphibian occurrences in this stream segment. The 1 mile of Grapevine Creek with occupied habitat for the Gila trout population occurs in the Grapevine Botanical Area within the Big Bug Creek Watershed.

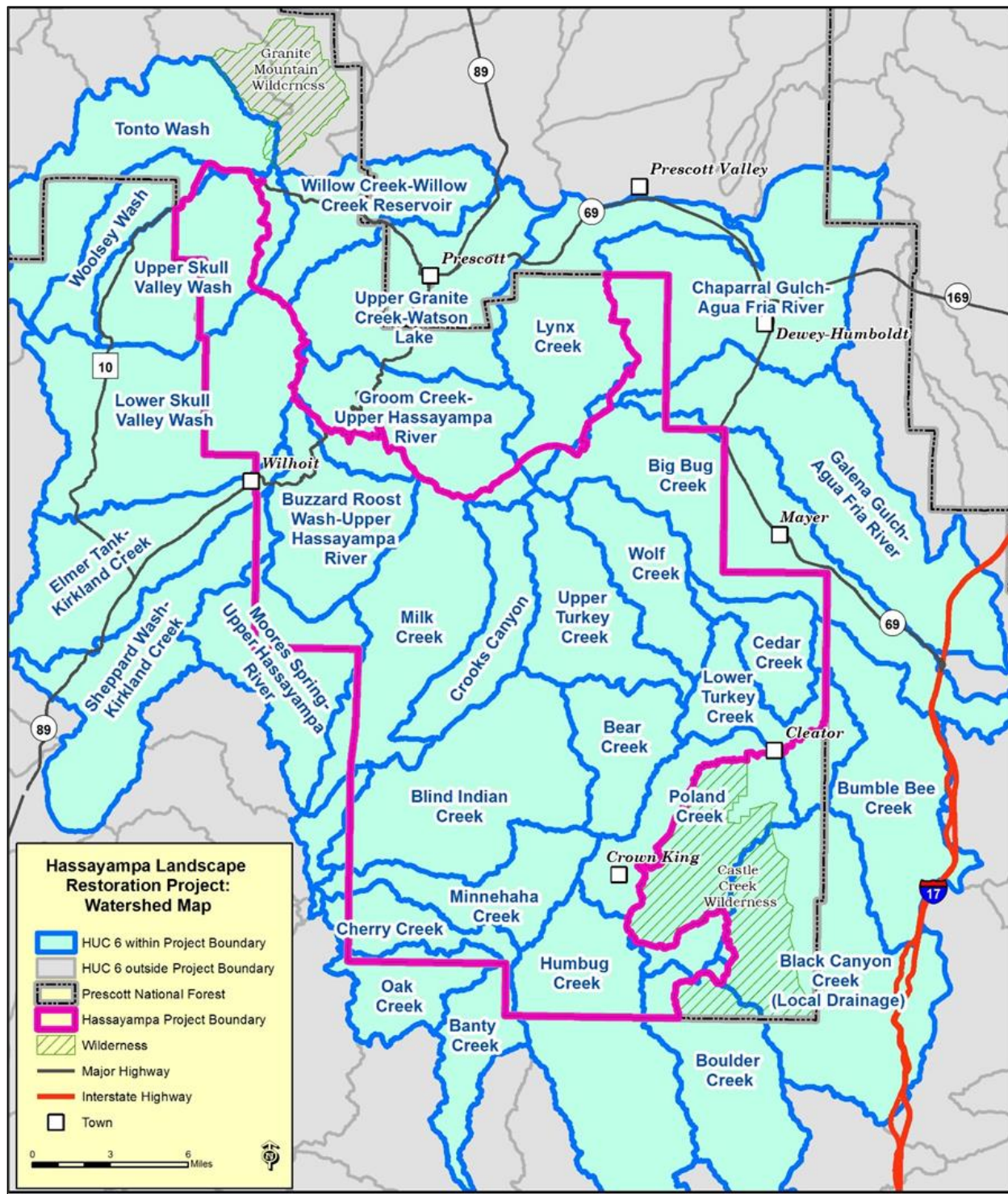


Figure 1. Watersheds associated with the Hassayampa Landscape Restoration Project

Table 4. Perennial/Intermittent stream miles located within the Hassayampa Project

6 th -Field HUC Watershed	Perennial Stream Miles	Intermittent Stream Miles	100-Foot Stream Management Zone (acres)
Bear Creek	0	59.3	1,437.6
Big Bug Creek	5.9	157.4	3,958.8
Blind Indian Creek	0	135.0	3,272.7
Boulder Creek*	0*	16.0*	387.9
Buzzard Roost Wash-Upper Hassayampa River	4.3	73.3	1,881.2
Cedar Creek	0	35.1	850.9
Chaparral Gulch-Agua Fria River	0	217.5	5,272.7
Cherry Creek	0	31.5	763.6
Crooks Canyon	0	57.2	1,386.7
Groom Creek-Upper Hassayampa River	7.4	84.7	2,232.7
Humbug Creek*	0.7*	53.7*	1,318.8
Lower Skull Valley Wash*	2.0*	58.3*	1,461.8
Lower Turkey Creek	0	63.0	1,527.3
Milk Creek	0	115.9	2,809.7
Minnehaha Creek	0	51.7	1,253.3
Moores Spring-Upper Hassayampa River	0	100.3	2,431.5
Oak Creek	0	38.1	923.6
Poland Creek	0.4	102.8	2,501.8
Upper Skull Valley Wash	0	113.5	2,751.5
Upper Turkey Creek	0	73.4	1,779.4
Wolf Creek	0	49.4	1,197.6
Total	20.7	1,559.1	41,401.2

* Only those stream miles located on National Forest System lands were included in the total calculations.

Existing Conditions for Resource Indicators and Measures

Sediment Delivery

Surface erosion and runoff in the 6th-field watershed is influenced by many factors such as soils types, vegetative cover, and slopes. Natural erosion in the watersheds occurs with precipitation events and results in sediment input to streams, which are incorporated and eventually processed through the system (sediment transport). Excessive sediment can be generated from proposed forest management activities based on the inherent potential for erosion in the project area, which could overwhelm the streams capacity to assimilate and transport the sediment through the system. A measure of soil loss is the erosion hazard rating. Information on the erosion hazard for the project area described below is summarized from the Soils Resource specialist report.

The inherent potential for erosion exist in the project area, given some form of past disturbance and also from natural erosion levels of soils, especially on slopes greater than 40 percent (50 percent of the project area). The erosion hazard ratings and acres by potential natural vegetation type are listed in Table 5. Erosion hazard ratings can vary from low to severe, with low ratings meaning low probability of adverse effects on soil and water quality if accelerated surface erosion occurs. Moderate erosion hazard rating mean that accelerated erosion is likely to occur in most years and water quality impacts may occur. Severe

erosion hazard rating means that effects to soil productivity and water quality are likely to occur when accelerated erosion happens. Although much of the project area has severe erosion hazard rating (Table 5), the actual erosion hazard is lower under current conditions, mostly due to the fact that there is not a lot of bare soil exposed. Most of the soil has some cover (rock, woody debris, vegetation, or litter). Erosion hazard is likely still moderate to severe where slopes are steeper than 40 percent and bare soil exists. Fire in the project area can increase soil erosion potential where soils become water repellent (hydrophobic) and/or there is high consumption of protective ground cover which can increase erosion and runoff to streams.

Table 5. Erosion hazard acreage by potential natural vegetation type within the Hassayampa Project area

Potential Natural Vegetation Type	Erosion Hazard (Acres)		
	Slight	Moderate	Severe
Desert Communities	0	0	245
Interior Chaparral	2,433	46,321	91,234
Juniper Grassland	685	760	9,234
Piñon-Juniper Evergreen Shrub	1,649	9,945	12,731
Ponderosa Pine-Evergreen Oak	0	3,288	8,076
Ponderosa Pine-Gambel Oak	2,838	717	13,870
Riparian Gallery	3,222	0	0
Semi-Desert Grassland	4,957	3,710	30,330
Total Acres	15,784	64,741	165,720
Percent of Project Area	6	26	67

Water Temperature

The temperature of a body of water influences its overall quality. Water temperatures outside the “normal” range for a stream or river can cause harm to the aquatic organisms that live there. Shade is very important to the health of a stream because of the warming by direct sunlight. Forest thinning activities within the 100-foot stream management zone of perennial and intermittent streams in the project area may remove shade trees from the area which would allow more sunlight to reach the water, causing the water temperature to rise.

The condition of the Riparian Gallery forest is a main contributing factor to providing shade along the streams in the project area. The watershed condition class ratings for the Forest indicates that riparian areas conditions are considered “poor” in five of the 6th-field watersheds, “fair” in five of the 6th-field watersheds, and “good” in one of the 6th-field watersheds within the project area. Poor riparian conditions are represented by areas that have very limited presence and reproduction of mid- to late-seral species. Fair riparian conditions are represented by areas that are still dominated by mid- to late-seral species, but with light to moderate impacts to structure, reproduction, composition, and cover. Good riparian conditions are represented by areas that are dominated by native mid- to late-seral vegetation (appropriate to site potential) with diverse age, structure, composition, and cover.

Water temperature data-loggers have been installed in Big Bug Creek and Grapevine Creek in the project area. Water temperature monitoring in Grapevine Creek conducted from July 2008 to April 2009 reported daily maximum stream temperatures not exceeding 20 °C (Anderson 2014). Information on water temperature changes in these streams post-Goodwin Fire are being collected.

Species Identification

Federally listed and Southwestern Region of the Forest Service (Region 3) Sensitive species or their habitats known in the Hassayampa Project area or potentially affected by actions in the project area are listed in Table 6. See appendix B and C for the complete lists of these species for the Prescott National Forest. Those fish and aquatic species on the Forest list not affected by the project are discussed in appendix D with the rationale for excluding them from detailed analysis and the resulting **no effect** determination.

Table 6. Species identified for the Hassayampa Project

Common Name	Scientific Name	Federal Status	Critical Habitat
Gila trout	<i>Oncorhynchus gilae</i>	Threatened ¹	None
Desert sucker	<i>Catostomus clarki</i>	Sensitive ²	N/A
Lowland leopard frog	<i>Lithobates (Rana) yavapaiensis</i>	Sensitive	N/A
Verde Rim springsnail	<i>Pyrgulopsis glandulosa</i>	Sensitive	N/A

¹ Listed threatened under the Endangered Species Act: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

² Regional Forester's Sensitive Species for the Southwestern Region of the Forest Service found on the Prescott National Forest.

Gila Trout

Status Range-wide/Life History

The Gila trout was originally recognized as endangered under the Federal Endangered Species Preservation Act of 1966 and then under the Endangered Species Act of 1973. The Gila trout was downlisted from endangered to threatened in 2006 (U.S. Fish and Wildlife Service 2006). No critical habitat has been designated for Gila trout. The Gila trout is endemic to the Gila River Basin of New Mexico and Arizona and is found in moderate- to high-gradient-perennial mountain streams above 5,400 feet to over 9,200 feet elevation. Currently, there are 16 populations of Gila trout in the wild (U.S. Fish and Wildlife Service 2003). Primary threats to Gila trout include hybridization, competition, and/or predation by non-native trout species, habitat degradation, and wildfire.

The following information on Gila trout habitat requirements is taken from the revised Recovery Plan (U.S. Fish and Wildlife Service 2003). Gila trout is found in moderate- to high-gradient-perennial mountain streams above 1,660 meters (5,400 feet) elevation. Streams typically flow through narrow, steep-sided canyons and valleys. The species requires water temperatures below 25 °C (77 °F), clean gravel substrates for spawning, continuous stream flow of sufficient quantity to maintain adequate water depth and temperature, and pool habitat that provides refuge during low flow conditions and periods of thermal extremes. Abundant invertebrate prey, cover, and water free from contaminants are also required. Cover typically consists of undercut banks, large woody debris, deep pools, exposed root masses of trees at water's edge, and overhanging vegetation. Populations of Gila trout are particularly sensitive to impacts that cause reductions in cover and pool depth.

Spawning of Gila trout occurs mainly in April. Spawning begins when temperatures reach about 8 °C (46 °F), but day length may also be an important cue. Female Gila trout typically construct redds in water 6 to 15 centimeters (2.4 to 6 inches) deep within 5 meters (16 feet) of cover. Fry (20 to 25 millimeters [0.8 to 1.0 inch] total length) emerge from redds in 56 to 70 days. Suitable spawning habitat substrate composition for development of eggs and embryos is characterized by approximately 7 percent or less fines (particles less than 1 millimeter [0.04 inch] diameter) by weight. Coarse sands and gravels ranging from 1 millimeter (0.04 inch) to 18 millimeters (0.7 inches) diameter compose approximately 60 percent of the substrate in suitable habitat for eggs and embryos.

Status in the Analysis Area

Gila trout were introduced into Grapevine Creek (Big Bug Creek 6th-field watershed) in 2009. The majority of the Big Bug Creek 6th-field watershed is in Prescott National Forest (42 percent) and other Federal and state ownership (32 percent). The perennial reach of Grapevine Creek is entirely within the Prescott National Forest and occurs within the Grapevine Botanical Area. This area is excluded from livestock grazing (USDA Forest Service 1997). Also, this area has additional management direction for no motorized or mountain bike use of trails within the botanical area, and recreation use is restricted to day use only. Forest Trail #4 accesses Grapevine Botanical Area and parallels the creek for about 0.5 miles. Overall, recreation opportunities are limited and use is low. There are no mining activities within the Grapevine Botanical Area.

The perennial reach of Grapevine Creek begins at the Grapevine Springs complex and flows for about a mile within the Grapevine Botanical Area (Figure 2). Downstream of this perennial reach, the creek is intermittent for about 0.6 miles and then ephemeral for the next 2.7 miles to the confluence with Big Bug Creek. Water temperature monitoring was conducted in 2008 to 2009 with daily maximum stream temperatures not exceeding 20 °C (Anderson 2014). The main vegetation types within the upper Grapevine Creek drainage area with perennial water are Ponderosa Pine/Gambel Oak and Chaparral. The drainage is relatively narrow with an easterly flow and gradients of 3 to 7 percent. Slopes along the drainage are generally between 30 to 60 percent. The riparian vegetation associated with the perennial springs and stream is an Arizona alder and Arizona walnut community.

The Goodwin Fire in July of 2017 burned within Gila trout occupied habitat in Grapevine Creek. Of the 892-acre Grapevine Creek drainage area within the botanical area, 734 acres (82 percent) burned with some level of burn severity and 158 acres were unburned (Figure 2). About 330 acres (37 percent) burned with low severity; 350 acres (39 percent) with moderate burn severity; and 54 acres (6 percent) burned with high burn severity. The majority of the moderate and high burn severity occurred along the perennial reach of Grapevine Creek. There was high accelerated erosion and soil loss in areas that experienced moderate to high soil burn severity, due to water repellency, limited soil cover, and steep slopes. Field observations of Grapevine Creek in October 2017 noted fire impacts to riparian and aquatic resources. The majority of pool habitats had filled with sediment post flooding in the drainage. Electrofishing and visual surveys of Grapevine Creek did not report any Gila trout present in the system (Stephens 2017 pers. comm.). Field observations of Grapevine Creek in September 2018 to assess the stream noted that pool and substrate conditions were suitable for restocking of Gila trout (Stephens 2018 pers. comm.). Restocking is scheduled for 2019.

Surface erosion and runoff in the upper Grapevine Creek watershed is influenced by many factors such as soils types, vegetative cover, and slopes. Natural erosion in the watershed occurs with precipitation events and results in sediment input to the stream, which is incorporated and eventually processed through the system (sediment transport). Excessive sediment can be generated from proposed forest management activities based on the inherent potential for erosion in the project area, which could overwhelm the streams capacity to assimilate and transport the sediment through the system. A measure of soil loss is the erosion hazard rating. Information on the erosion hazard for the project area described below is summarized from the Soils Resource specialist report. The erosion hazard ratings and acres by potential natural vegetation type in the Grapevine Creek watershed are shown in Figure 3.

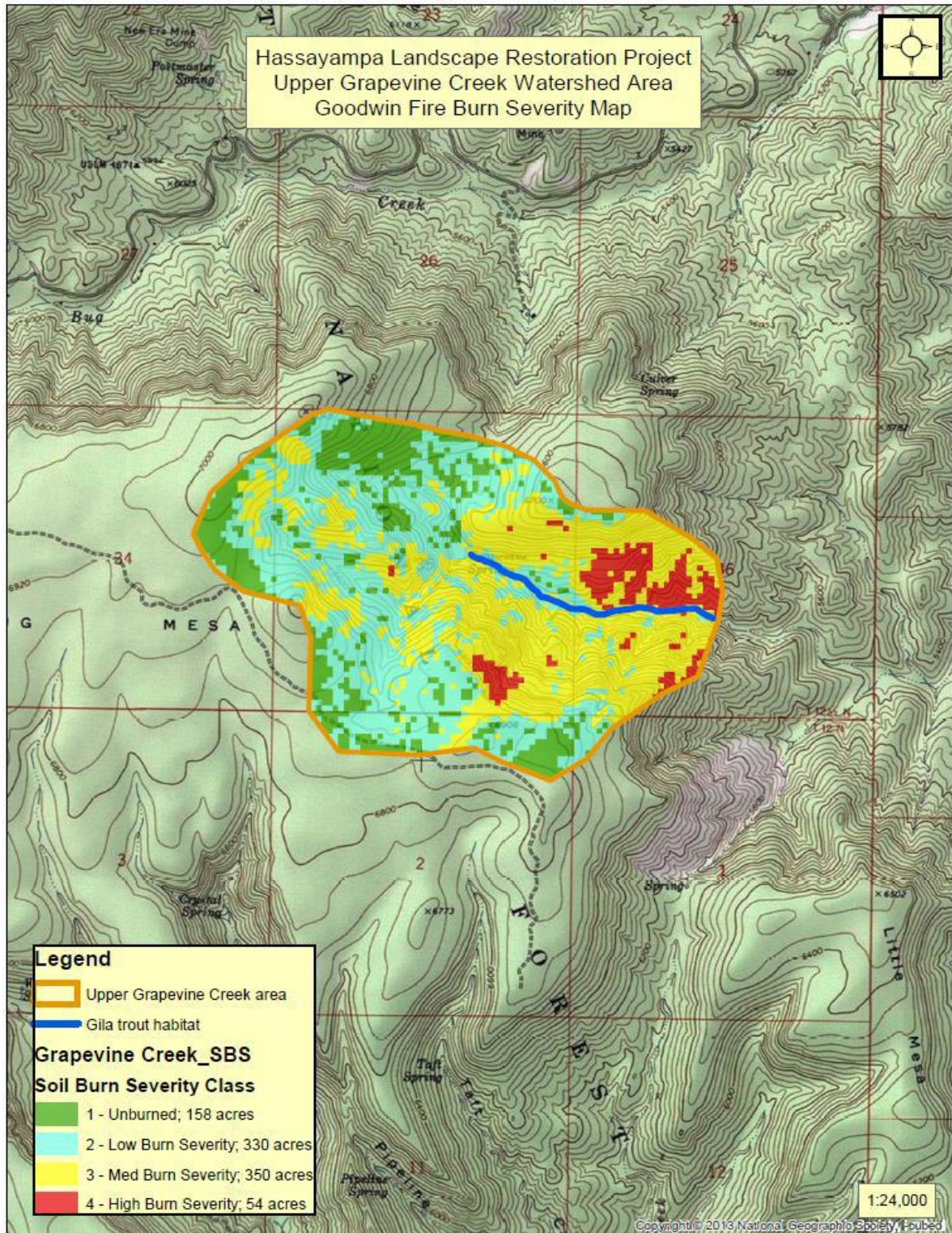


Figure 2. Goodwin Fire Burn Severity Map – Grapevine Botanical Area

The inherent potential for erosion exist in the project area, given some form of past disturbance and also from natural erosion levels of soils, especially on slopes greater than 40 percent. Erosion hazard ratings can vary from low to severe, with low ratings meaning low probability of adverse effects on soil and water quality if accelerated surface erosion occurs. Moderate erosion hazard rating mean that accelerated erosion is likely to occur in most years and water quality impacts may occur. Severe erosion hazard rating means that effects to soil productivity and water quality are likely to occur when accelerated erosion happens. Although much of the project area has severe erosion hazard rating, the actual erosion hazard is lower under current conditions, mostly due to the fact that there is not a lot of bare soil exposed. Most of the soil has some cover (rock, woody debris, vegetation, or litter). Erosion hazard is likely still moderate to severe where slopes are steeper than 40 percent and bare soil exists. Fire in the project area can increase soil erosion potential where soils become water repellent (hydrophobic) and/or there is high consumption of protective ground cover which can increase erosion and runoff to streams.

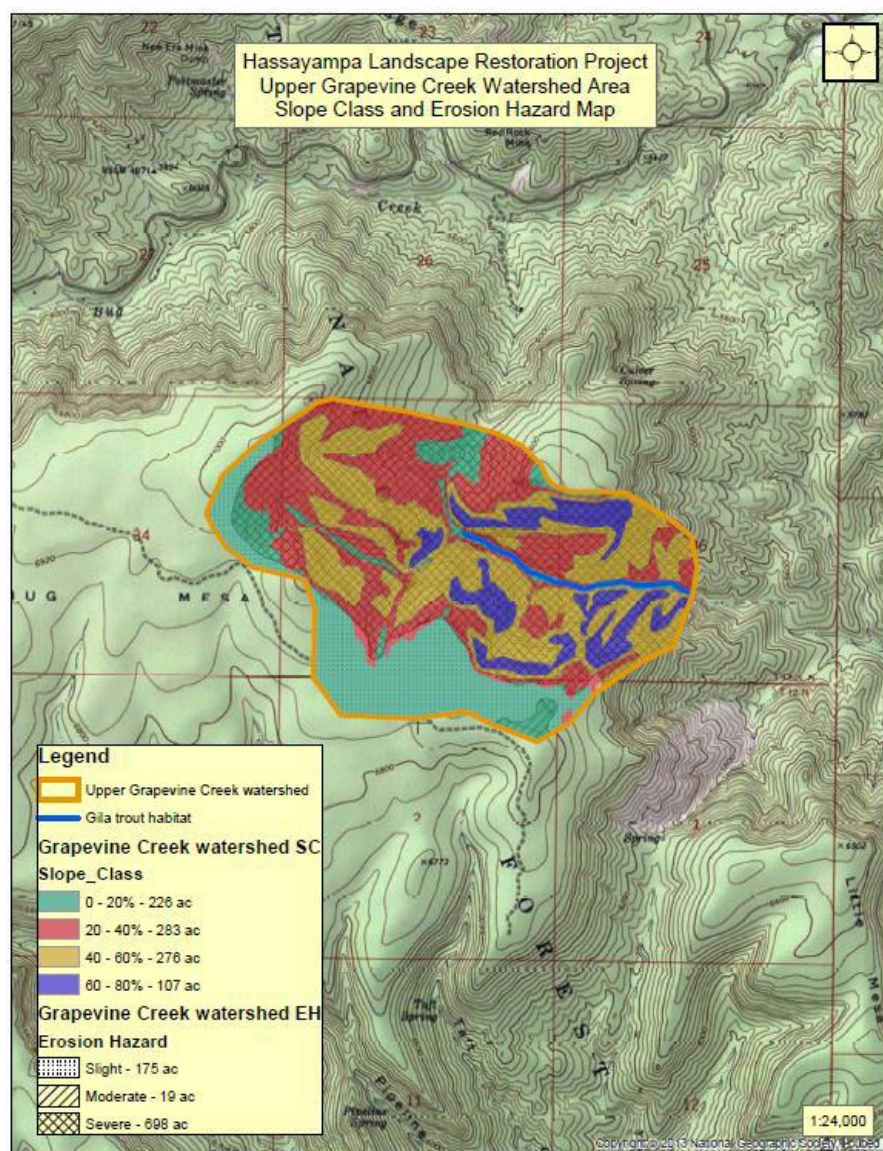


Figure 3. Slope Class and Erosion Hazard Ratings – Grapevine Botanical Area.

Water temperature data-loggers have been installed in Grapevine Creek in the project area. Water temperature monitoring in Grapevine Creek conducted from July 2008 to April 2009, March 2016 to July 2017, and October 2017 to May 2018 reported daily maximum stream temperatures not exceeding 20 °C (Anderson 2014, Tracy Stephens 2018 pers. comm.). Information on water temperature changes in this stream post-Goodwin Fire will continue to be collected.

Desert Sucker

Status Range-wide/Life History

The desert sucker is listed as a Region 3 Sensitive Species (USDA Forest Service 2017). The species occur in the Bill Williams, Salt, Gila, and San Francisco River drainages in the lower Colorado River Basin within Utah, Nevada, Arizona, and New Mexico (Arizona Game and Fish Department 2002a; Nature Serve 2008). This fish is found in rapids and flowing pools of streams and rivers primarily over bottoms of gravel-rubble with sandy silt in the interstices. Elevation ranges from 480 to 8,840 feet. Threats to the species and their habitats include introduction and spread of non-native aquatic species, and habitat destruction from a variety of human activities.

Spawning occurs generally in late winter and early spring. Adhesive eggs are deposited in a shallow depression made in the gravel. Eggs hatch in a few days. Adults are primarily herbivorous, scraping diatoms and algae from stones as well as ingesting plant detritus. Juveniles eat primarily Chironomid larvae.

Status in the Analysis Area

The species is known to occur in Hassayampa River, Milk Creek, Blind Indian Creek, Cellar Springs Creek, and Big Bug Creek within the project area (Voeltz and Bettaso 2003; Desert Fishes Team 2004). However, the amount of suitable or occupied habitat and thus species population is limited because of the limited amount of perennial streams in the project area. The Upper Hassayampa River has the most perennial water but there are many mining activities along the river that impact aquatic habitat quality. The Hassayampa River from the headwaters to the Copper Creek confluence (11 miles) is listed in the 2012/14 water quality report (Arizona Department of Environmental Quality 2015) as not attaining water quality standards to support designated uses for Warmwater Aquatic and Wildlife because of unacceptable levels of various metals and low pH due to mining operations. This impairment most likely impacts the desert sucker population in this stream segment. Portions of the Big Bug Creek 6th field watershed burned with moderate- to high-burn severity from the Goodwin Fire in 2017. The impacts to the desert sucker populations and aquatic habitat is unknown.

Lowland Leopard Frog

Status Range-wide/Life History

The lowland leopard frog is listed as a Region 3 Sensitive Species (USDA Forest Service 2017). Lowland leopard frog occurs in perennial aquatic systems in grassland to piñon-juniper woodlands from central to southeastern Arizona below the Mogollon Rim, generally below elevations of 6,200 feet (Arizona Game and Fish Department 2006). They are habitat generalist and can be found in rivers, streams, springs, and earthen cattle tanks. Adults breed primarily from January to May. Egg masses are attached to submerged vegetation, bedrock, or gravel in perennial water. Eggs hatch in 15 to 18 days. Larvae can metamorphose in 3 to 4 months or as long as 9 months. Adults eat arthropods and other invertebrates. Larvae are herbivorous and likely eat algae, organic debris, plant tissue, and minute organisms in water. Dense streamside vegetation is important escape cover (Zwartjes et al. 2005). Other important streamside

vegetation structures include tree root wads, debris piles, and logs. The greatest threats to this species are habitat alteration and fragmentation, accentuated by the introduction of non-native predatory and competitive fishes, crayfishes, and bullfrogs.

Status in the Analysis Area

The species is known to occur in the Hassayampa River, Blind Indian Creek, Cellar Springs Creek, and Big Bug Creek within the project area (Voeltz and Bettaso 2003; Emmons and Nowak 2012). However, the amount of suitable or occupied habitat and thus species population is limited because of the limited amount of perennial streams in the project area. The Upper Hassayampa River and Big Bug Creek has the most perennial water for the species but there are many mining activities along the streams that impact aquatic habitat quality. The Hassayampa River from the headwaters to the Copper Creek confluence (11 miles) is listed in the 2012/14 water quality report (Arizona Department of Environmental Quality 2015) as not attaining water quality standards to support designated uses for Warmwater Aquatic and Wildlife because of unacceptable levels of various metals and low pH due to mining operations. This impairment most likely impacts the lowland leopard frog population in this stream segment. Portions of the Big Bug Creek 6th field watershed burned with moderate- to high-burn severity from the Goodwin Fire in 2017. The impacts to the lowland leopard frog populations and aquatic habitat is unknown.

Verde Rim Springsnail

Status Range-wide/Life History

The Verde Rim springsnail is listed as a Region 3 Sensitive Species (USDA Forest Service 2017). The total range of this species includes the Nelson Place Spring complex that forms the headwaters of Sycamore Creek (Agua Fria River drainage) and the Grapevine Springs complex along Grapevine Creek (Arizona Game and Fish Department 2003; Blanchette and Sorensen 2016).

Status in the Analysis Area

The Grapevine Springs population occurs within the project area within the designated Grapevine Botanical Area. There are four populations associated with the Grapevine Springs complex sources along Grapevine Creek. Populations were considered healthy in 2016 (Blanchette and Sorensen 2016). The Grapevine Botanical Area is excluded from livestock grazing. Also, this area has additional management direction for no motorized or mountain bike use of trails within the botanical area, and recreation use is restricted to day use only (USDA Forest Service 1997). Forest Trail #4 accesses Grapevine Botanical Area and parallels the creek for about 0.5 miles. Overall, recreation opportunities are limited and use is low. There are no mining activities within the Grapevine Botanical Area.

The Verde Rim springsnail populations within the Grapevine Springs complex were also affected by the Goodwin Fire as described above under Gila trout. Two of the four spring sites experienced high erosion and downcutting within springsnail habitat. Springsnail populations within these two spring areas were either loss or diminished due to loss of habitat (Sorensen 2017 pers. comm.).

Environmental Consequences

Alternative 1–No Action

A no-action alternative has been included as a baseline for comparison to the action alternative. This alternative represents the existing and projected future condition against which other alternatives are compared. Under this alternative, no fuel reduction treatments would be implemented. No prescribed fire, mechanical treatments (thinning or mastication), or hand thinning would occur. As such, the fuels loadings and overgrown conditions would continue to worsen. Natural processes of decay are not likely to remove the down and dead woody debris before the next fire cycle. As the available fuel increases, so would the potential for a large, stand-replacing wildfire event. Existing activities in the Hassayampa Project area such as road maintenance, fire suppression, firewood cutting, grazing, hunting, and recreational activities would continue.

Sediment Delivery and Water Temperature

Potential wildfire effects in the project area would depend on how much of the 6th-field HUC watershed is affected. In addition, the physical character of the watershed such as vegetation and soil types, vegetation seral stages, slopes, and other factors would influence wildfire intensity and burn severity. High-severity wildfires can increase runoff and erosion rates by two or more orders of magnitude (Elliot et al. 2010). This could be expected in the chaparral vegetation types that tend to have high severity burns. Wildfire is expected to result in post-fire runoff that could substantially increase sedimentation to the perennial and intermittent stream systems in the project area.

Wildfire can result in direct effects to aquatic resources through elevated water temperature resulting in lethal fatality of aquatic species and from the reduction in streamside vegetation and associated increases in insolation. The reduction or removal of the overhead canopy in riparian areas is frequently associated with a decrease in stream shading and a concomitant increase in water temperature. However, temperature changes are generally not lethal to aquatic organisms and water temperatures decline as vegetation becomes reestablished. Effects depend on the burn intensity, spatial pattern of the burn, stream size, stream network complexity, watershed topography, and normal temperature ranges of affected stream reaches.

Effects to Aquatic Species

There would be no actions taken under this alternative so there would be no direct or indirect effects to the Gila trout and Verde Rim springsnail or their habitats in the Grapevine Creek area. The impacts of the Goodwin Fire 2017 to the aquatic/riparian resources of Grapevine Creek are yet to be determined.

Also, there would be no direct or indirect effects to the desert sucker and lowland leopard frog or their habitat in the analysis area; their population and habitat conditions would remain similar to current conditions. The risk of a large, high-severity wildfire would remain and could increase over time. Wildfire could substantially increase sedimentation, ash, and debris flow to perennial streams. Impacts to aquatic habitat could cause a decrease in habitat quantity and quality with the deposition of excessive sediment in riffles and pools and the smothering of macroinvertebrates that are a main food sources for these species.

Alternative 2–Proposed Action

The Forest is proposing to reduce fuels and restore fire as an ecological process on approximately 234,515 acres. Opportunities for treatments are proposed in a variety of potential natural vegetation types including Semi-Desert Grasslands, Juniper Grasslands, Piñon-Juniper Evergreen Shrub, Interior Chaparral, Ponderosa Pine-Evergreen Oak, Ponderosa Pine-Gamble Oak, Desert Communities, and Riparian Gallery forest. Mixed conifers are included in the Ponderosa pine-Oak potential natural vegetation types and would be treated as part of this project. A variety of methods are being considered to reduce fuels and create and maintain healthy and resilient ecosystems, including hand thinning or pruning, prescribed burning, and mechanized and non-mechanized fuel reduction treatments. A combination of vegetation management treatments, including mechanized and non-mechanized fuels treatments, prescribed burning, and fuel break construction, would be used to attain desired conditions. The treatments being proposed are based on the vegetation being managed.

This project also includes resource protection measures, which are intended to assure that projects comply with standards and guidelines of the Prescott Land Management Plan, as well as other Federal and state laws, regulations, and policy. Resource protection measures are a required component of the proposed action and are intended to reduce, minimize, or eliminate impacts to various natural and human resources. The full list of resource protection measures are provided in the environmental assessment.

Direct and Indirect Effects

The amount of proposed treatments by watershed area are shown in Table 3. The following treatment methods proposed within the Hassayampa Project area will be used to analyze direct and indirect effects to aquatic resources: prescribed fire, mastication, mechanical thinning, and fuelbreak construction. Prescribed burning is proposed on approximately 231,353 acres of the project area; this includes all potential natural vegetation types except Desert Communities. It is anticipated an average of 10,000 acres would be treated annually; however, annual treatments would be determined by the needs on the landscape and available funding. The treatments are described in detail in the environmental assessment. The direct and indirect effects to aquatic resource measures in the project area are listed in Table 7.

Table 7. Resource indicators and measures for alternative 2 direct/indirect effects

Resource Element	Resource Indicator	Measure	Area	Acres of Hand & Mechanical Vegetation Treatments	Acres of Prescribed Fire Treatments
Aquatic Habitat Quantity and Water Quality	Sediment Delivery	Total proposed vegetation treatments within select 6 th -field HUC watersheds	Bear Creek	2,897	12,033
			Big Bug Creek	11,006	18,203
			Blind Indian Creek	9,367	29,740
			Boulder Creek	511	2,069
			Buzzard Roost Wash-Upper Hassayampa River	3,167	17,404
			Cedar Creek	2,149	8,255
			Chaparral Gulch-Agua Fria River	2,292	5,320
			Cherry Creek	389	6,566
			Crooks Canyon	5,666	11,983
			Groom Creek-Upper Hassayampa River	1,781	4,381
			Humbug Creek	3,009	11,949

Resource Element	Resource Indicator	Measure	Area	Acres of Hand & Mechanical Vegetation Treatments	Acres of Prescribed Fire Treatments
			Lower Skull Valley Wash	8,336	12,286
			Lower Turkey Creek	819	8,272
			Milk Creek	7,221	22,722
			Minnehaha Creek	4,420	12,445
			Moore's Spring-Upper Hassayampa River	36	5,413
			Oak Creek	431	1,805
			Poland Creek	5,330	12,175
			Upper Skull Valley Wash	4,816	9,350
			Upper Turkey Creek	9,144	16,408
			Wolf Creek	5,675	12,582
Aquatic/ Riparian Habitat and Water Quality	Water Temperature	Total proposed vegetation treatments within 100 feet of perennial/ intermittent streams within select 6 th -field HUC watersheds	Bear Creek	326	326
			Big Bug Creek	315	315
			Blind Indian Creek	84	84
			Boulder Creek	18	18
			Buzzard Roost Wash-Upper Hassayampa River	107	107
			Cedar Creek	0	0
			Chaparral Gulch-Agua Fria River	79	79
			Cherry Creek	0	0
			Crooks Canyon	307	307
			Groom Creek-Upper Hassayampa River	101	101
			Humbug Creek	145	145
			Lower Skull Valley Wash	15	15
			Lower Turkey Creek	267	267
			Milk Creek	145	145
			Minnehaha Creek	0	0
			Moore's Spring-Upper Hassayampa River	0	0
			Oak Creek	185	185
			Poland Creek	127	127
			Upper Skull Valley Wash	684	684
			Upper Turkey Creek	467	467
			Wolf Creek	326	326

Sediment Delivery

Approximately 231,000 acres of prescribed fire and 90,000 acres of fuels reduction treatments would occur within select 6th-field HUC watersheds in the project area being analyzed for aquatic resources. No ignition would occur in established stream management zones and the target burn intensity in stream management zones would be low; therefore, creating an adequate buffer to filter the majority of mobilized erosion before entering project area streams. These measures would protect water quality from prescribed fire over the life of the project. Prescribed fire would be minimally utilized on slopes greater than 40 percent and extra measures would be taken to ensure soil cover remains intact (Soil Design Feature H-5). There would be indirect effects of sedimentation to aquatic resources from proposed prescribed fire activities occurring in the uplands of the watersheds.

Potential indirect effects from prescribed fire to aquatic resources would depend on how much of the 6th-field HUC watershed is treated and the level of soil burn severity. The physical character of the watershed such as vegetation and soil types, vegetation seral stages, slopes, and other factors would influence burn severity. Prescribed fire would typically result in a mosaic pattern of burned and unburned vegetation and predominately low-burn severity in most potential natural vegetation types. High burn intensities tend to be associated with Chaparral Potential Natural Vegetation Type which makes them vulnerable to hydrophobic soil conditions and high levels of canopy cover consumptions (Nearby 2005). High severity fires can increase runoff and erosion rates by two or more orders of magnitude, while low and moderate severity burns have much smaller effects on runoff and sediment yields (Elliot et al. 2010). In the short term, the potential for soil erosion could increase post-fire, especially on areas where slopes are steep and the current soil erosion rates are already above tolerable levels. Erosional effects would be most extreme where the majority of vegetation and duff has been consumed by fire, soils are highly erosive, and large precipitation events occur soon after the fire (Gresswell 1999). The implementation of resource protection measures for potential natural vegetation types, hydrology and watershed resources, and soils would reduce impacts to stream channels, riparian areas, and water quality from sedimentation from upland treatments to aquatic resources in the project area.

Approximately 90,000 acres of hand and mechanical fuel reduction treatments would occur across the landscape in the project area. A total of 4,317 acres of hand treatments would occur in areas where slopes are greater than 80 percent as well as in sensitive sites such as within stream management zones. This would entail hand thinning using a chainsaw. Slash would be piled or scattered following treatment. Prescribed fire would also be applied to these treatment areas following thinning. Soil loss would be minimal because slash would be left on site.

Mechanical thinning would be implemented within forest potential natural vegetation types on approximately 31,289 acres. This would help create a residual stand structure and level of fuels that would reduce the potential for crown fire under typical weather conditions that occur in the project area. A total of 44,590 acres of mastication is proposed in various potential natural vegetation types (predominately chaparral) on slopes less than 40 percent. These treatments would result in soil disturbance which would be mitigated by the implementation of resource protection measures to maintain/improve vegetative ground cover to reduce erosion from treated areas.

There would be localized short-term effects of sedimentation from treatments in the 6th-field watersheds to aquatic resources, but habitat quantity and water quality should be maintained within acceptable levels. Overall, this alternative would improve soil and watershed conditions, restore the natural fire regime, and reduce the potential for wildfire. This would have long-term beneficial effects to the species and their habitat in the project area.

Water Temperature

There are 41,401 acres in the 100-foot stream management zone of perennial and intermittent streams within the project area (Table 4). A total of 3,367 (8 percent of total stream management zone area) acres have proposed hand and/or mechanical treatments within the zones. Tree thinning within these zones using various mechanical and hand methods would reduce tree densities and fuel loads to desired conditions. Implementation of resource protection measures for the stream management zones, such as no treatment of facultative or obligate riparian vegetation in the zone, should mitigate any major changes to water temperatures within the small amount of stream management zone area being treated. This would maintain water quality for aquatic species in the project area.

Effects to Aquatic Species

Gila Trout and Verde Rim Springsnail

The vegetation treatments proposed within the upper Grapevine Creek watershed include prescribed fire and hand thinning. Most of the upper Grapevine Creek watershed area is open to prescribed fire. As this area falls within the Goodwin Fire perimeter it would receive maintenance burns in the future based on ecological conditions related to fire regimes and PNVTs. In addition, a total of 535 acres are proposed for hand thinning with chainsaws (Figure 4). Given the impacts from the recent Goodwin Fire, no mechanical treatments would be implemented within the Grapevine Botanical area. In addition, there would be no effects from fuel break construction or transportation actions because these actions would not occur in the Grapevine Botanical area.

This project also includes resource protection measures, which are intended to assure that projects comply with standards and guidelines of the Prescott Land Management Plan, as well as other Federal and state laws, regulations, and policy. Resource protection measures are a required component of the proposed action and are intended to reduce, minimize, or eliminate impacts to various natural and human resources. The full list of resource protection measures are provided in the environmental assessment. Specific resource protection measures relevant to this analysis are addressed in this section and listed in Appendix A of this document.

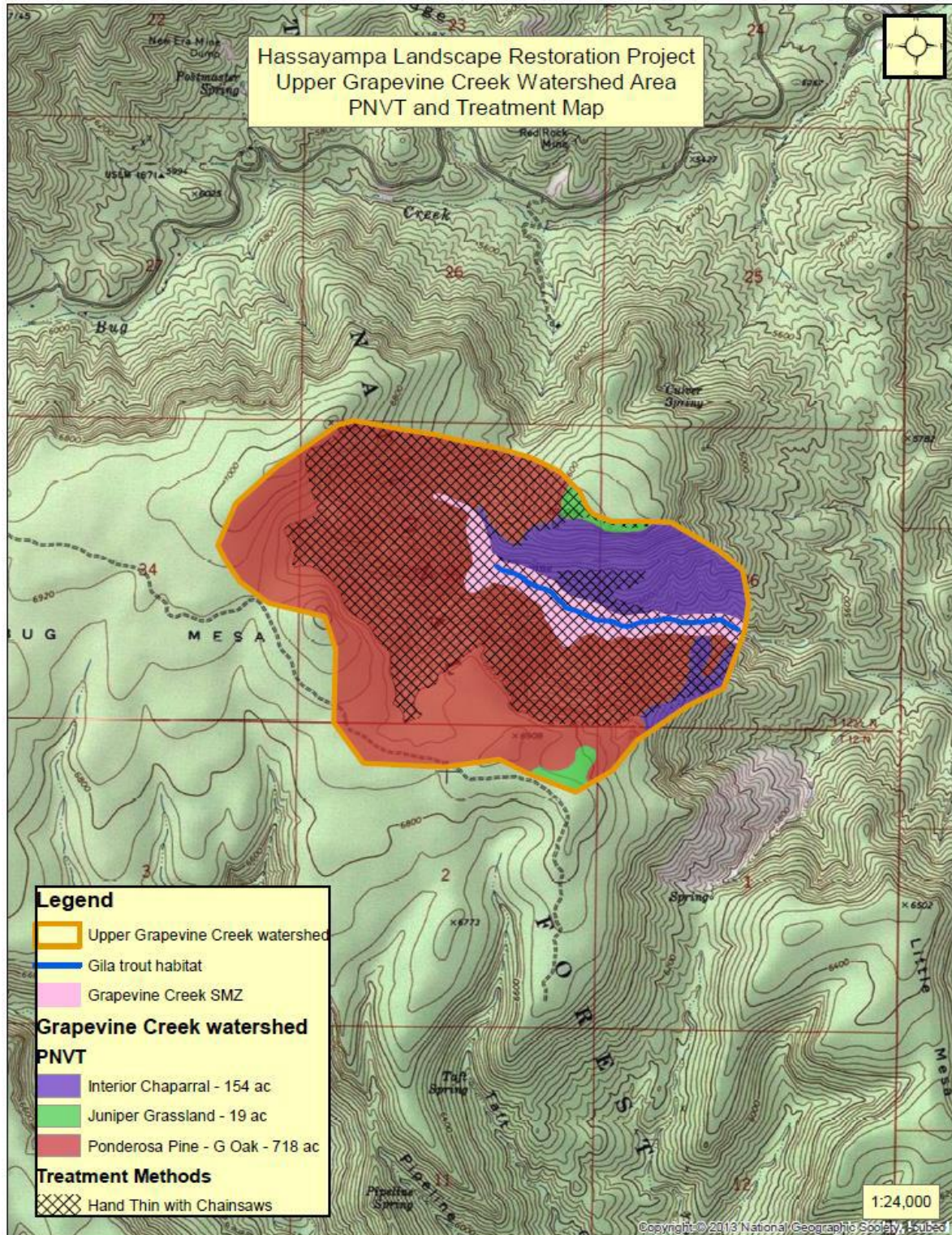


Figure 4. Upper Grapevine Creek Watershed PNV and Treatment map.

Direct and Indirect Effects

Prescribed Fire Effects

Prescribed fire treatments would occur within the upper Grapevine Creek watershed in the project area being analyzed for aquatic resources. The majority of this watershed (718 acres, 80%) is in the Ponderosa pine-Gambel oak vegetation type. The Desired Condition for the vegetation type is for frequent, low burn severity fires, occurring in a 1 to 15 year fire return interval. The Interior chaparral vegetation type makes up 17% (152 acres) of the watershed with a Desired Condition for infrequent, high burn severity fire, occurring every 35 to 100 years.

With implementation of resource protection measures (G-1, G-5, G-6, G-10), direct effects to Gila trout and Verde Rim springsnail are unlikely because no direct fire ignition would occur within the established stream management zone (SMZ) for Grapevine Creek, and any fire backing into the Grapevine Creek SMZ would be managed for a low burn intensity. This should reduce the potential for direct heating of water temperatures, provide an adequate buffer to filter the majority of mobilized erosion before entering project area stream, and maintain riparian vegetation along upper Grapevine Creek. These measures would help to protect Gila trout and Verde Rim springsnail from prescribed fire over the life of the project.

There would be potential for indirect effects from sedimentation to Gila trout and Verde Rim springsnail and their habitats with prescribed fire treatments in the upper Grapevine Creek watershed. Potential indirect effects from prescribed fire would depend on how much of the upper Grapevine Creek watershed is treated and the level of soil burn severity. The physical character of the watershed such as vegetation and soil types, vegetation seral stages, slopes, and other factors would influence burn severity (Figure 3). Prescribed fire treatments would have short-term impacts to soil productivity and increased runoff and erosion in the treated area due to the decrease in vegetative cover. With implementation of resource protection measures (A-3, A-4), prescribed fire would typically result in a mosaic pattern of burned and unburned vegetation and predominately low-burn severity in most potential natural vegetation types which would reduce the above impacts. In the short term, the potential for soil erosion could increase post-fire, especially on areas where slopes are steep and the current soil erosion rates are already above tolerable levels. Erosional effects would be most extreme where the majority of vegetation and duff has been consumed by fire, soils are highly erosive, and large precipitation events occur soon after the fire (Gresswell 1999). With implementation of resource protection measures (H-1, H-5), prescribed fire would be minimally utilized on slopes greater than 40 percent and extra measures would be taken to ensure soil cover remains intact.

Surface runoff and erosion are expected to occur with storm events (typically monsoons or winter) following treatments with sediment and nutrients being transported from the uplands and eventually inputted into Grapevine Creek. There would be short-term effects of sedimentation to water quality, macroinvertebrate communities, and deposition within pool and riffle habitats. The potential amount of sedimentation would be reduced through implementation of resource protection measures and with the natural hydrologic regime of Grapevine Creek drainages to transport sediment through the system, habitat and water quality should be maintained within acceptable levels for the Gila trout and Verde Rim springsnail in the long-term.

Overall, prescribed fire would improve soil and watershed conditions, restore the natural fire regime, and reduce the potential for wildfire. This would have long-term beneficial effects to the species and their habitat in the project area.

Hand Thinning Treatment Effects

A total of 77 acres have proposed hand treatments within the upper Grapevine Creek stream management zone. Tree thinning within this zone using hand methods would reduce tree densities and fuel loads to desired conditions. There would be no direct effects to Gila trout and Verde Rim springsnail because tree thinning would not occur within the aquatic environment or result in any direct contact with the species.

There may be indirect effects to Gila trout and Verde Rim springsnail from tree thinning within the upper Grapevine Creek SMZ due to reduced tree densities and potential impacts from solar radiation to water temperatures. Implementation of resource protection measures for the stream management zones (G-1, G-2, G-3, G-4, G-5), such as no treatment of facultative or obligate riparian vegetation in the zone, should mitigate any changes to water temperatures within the small amount of stream management zone area being treated. This would maintain favorable water temperatures for Gila trout and Verde Rim springsnail in the project area.

A total of 535 acres of hand treatments could occur in the upper Grapevine Creek watershed (Figure 4). Treatments would entail hand thinning using a chainsaw. Slash would be piled or scattered following treatment. With implementation of resource protection measures (A-3, H-1) tree thinning in the uplands of the upper Grapevine Creek watershed is unlikely to result in runoff and erosion from treated sites due to the increase in vegetative ground cover. Potential indirect effects of sedimentation in treated areas would be low and short-term. Habitat quantity and water quality should be maintained within acceptable levels to Gila trout and Verde Rim springsnail and their habitats in the Grapevine Creek watershed.

Overall, hand thinning treatments would improve vegetation conditions within the SMZ of Grapevine Creek, soil and watershed conditions within the Grapevine Creek watershed, restore the natural fire regime, and reduce the potential for wildfire. This would have long-term beneficial effects to the species and their habitat in the project area.

Desert Sucker and Lowland Leopard Frog

Direct and Indirect Effects

Prescribed Fire Effects

Direct effects to desert sucker and lowland leopard frog are unlikely because no direct fire ignition would occur within established stream management zones, and any fire backing into stream management zones are expected to be of low burn intensity and not affect the species or their habitat.

There would be indirect effects to desert sucker and lowland leopard frog within various streams from prescribed fire in the watershed and vegetation treatments in the stream management zone near occupied habitat. These treatments would have short-term impacts to soil productivity and increased sediment production in the treated area due to the decrease in vegetative cover. The amount of sediment generated from the project area from treatments would be reduced by implementation of resource protection measures (environmental assessment, appendix A) that would minimize short-term sedimentation and runoff. Surface erosion and runoff are expected to occur with storm events (typically winter or monsoons) following treatment. Sediment and nutrients would be transported downstream in drainages and eventually inputted into species habitat. There would be short-term effects to aquatic resources but habitat quantity and water quality should be maintained within acceptable levels. Fuelbreaks and temporary roads

would have no effects to species and their habitat because no activities would occur within stream management zones.

Hand Thinning and Mechanical Treatment Effects

There would be no direct effects to Desert sucker and Lowland leopard from because thinning activities would not occur within the aquatic environment or result in any direct contact with the species. There may be indirect effects to Desert sucker and Lowland leopard frog from thinning activities within the SMZ due to reduced tree densities and potential impacts from solar radiation to water temperatures. Implementation of resource protection measures for the stream management zones (G-1, G-2, G-3, G-4, G-5), such as no treatment of facultative or obligate riparian vegetation in the zone, should mitigate any changes to water temperatures within the small amount of stream management zone area being treated. This would maintain favorable water temperatures for Desert sucker and Lowland leopard frog in the project area.

Thinning treatments could occur in the SMZs of several watersheds with perennial streams (Table 4, 7). Treatments would generate slash which would be piled or scattered following treatment. With implementation of resource protection measures (A-3, H-1) thinning in the uplands of the watersheds are unlikely to result in runoff and erosion from treated sites due to the increase in vegetative ground cover. Potential indirect effects of sedimentation in treated areas would be low and short-term. Habitat quantity and water quality should be maintained within acceptable levels to Desert sucker and Lowland leopard frog and their habitats in the watersheds of the project area.

Overall, hand thinning treatments would improve vegetation conditions, soil and watershed conditions within the watersheds, restore the natural fire regime, and reduce the potential for wildfire. This would have long-term beneficial effects to the species and their habitat in streams the project area.

Cumulative Effects (Alternative 2)

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

In this analysis, 6th-field HUC watersheds are used as the basis to evaluate the cumulative effects of projects on aquatic resources. The cumulative effects analysis area for the Hassayampa Project includes the 21 6th-field HUCs watersheds listed in Table 3. Past, present, and reasonably foreseeable future activities occurring within the cumulative effects area are listed in the environmental assessment. Nine watersheds associated with the Bradshaw Vegetation Management Project overlap with the Hassayampa Project area. A total of 20,282 acres within the Big Bug Creek, Buzzard Roost Wash, Chaparral Gulch, Crooks Canyon, Groom Creek, Lower Skull Valley, Milk Creek, Upper Skull Valley, and Upper Turkey Creek Watersheds are considered for cumulative effects. The majority of these watersheds only have a small percentage (1 percent or less) of area in the 6th-field watershed. The majority of area is in the Groom Creek Watershed (16,924 acres and 73.8 percent of watershed) and Upper Skull Valley (2,054 acres and 9.3 percent of watershed).

Table 8. Resource indicators and measures for Alternative 2 cumulative effects

Resource Element	Resource Indicator	Measure	Alternative 2 Cumulative Effects
Aquatic Habitat Quantity and Water Quality	Sediment delivery	Total proposed vegetation treatments within select 6 th -field HUC watersheds	Localized, short-term effects to soil, watershed, and aquatic resources; Long-term beneficial effects to soil, watershed, and aquatic resource conditions. Aquatic habitat and water quality would be maintained with implementation of Forest Plan standards and guidelines, resource protection measures, and best management practices.
Aquatic/Riparian Habitat and Water Quality	Water temperature	Total proposed vegetation treatments within 100 foot of perennial/intermittent streams within select 6 th -field HUC watersheds	Localized, short-term effects from vegetation treatment within stream management zones. No change in water temperature with implementation of Forest Plan standards and guidelines, resource protection measures, and best management practices.

Sediment Delivery

Prescribed fire in the affected watersheds associated with the Bradshaw Vegetation Management Project would result in similar effects to the soil resources and potential sediment delivery to streams in the project area as described above. Prescribed fire on soils with inherently unstable soil characteristics which are associated with erosive soils on steep gradients would be avoided or the prescribed fire's footprint would be minimal. Overall, the soil loss increases are expected to be minimal by aerial extent and short-term because of the prescribed burn design features and implementation of soil conservation practices identified in appendix A of the Bradshaw Vegetation Management Environmental Assessment.

Mastication in the Bradshaw Vegetation Management Project would generally have no change in soil loss from current conditions from this treatment because of retention of protective slash on the soil surface. Additional vegetative ground cover would be provided by implementation of soil conservation practices identified in appendix A of the Bradshaw Vegetation Management Environmental Assessment.

Thinning in Bradshaw Vegetation Management Project would create a high probability of negatively impacting soil function by disrupting the soils nutrient cycling capability and increasing runoff and erosion rates. Most potential soil erosion comes from skid trails and landings where bare mineral soil is exposed. However, potential soil damage from thinning activities would be mitigated through the implementation of soil conservation practices such as the retention of vegetative ground cover as identified in appendix A of the Bradshaw Vegetation Management Environmental Assessment.

Past, present, and reasonably foreseeable project activities within the Bradshaw Vegetation Management Project area 6th-field HUC watersheds that overlap with the Hassayampa Project would have short-term effects to soil resources. The implementation of resource protection measures for soil, watershed, and hydrologic resources would ensure protection of stream channels, riparian areas, and water quality from sedimentation from upland treatments to aquatic resources in the project area. Overall, upland soil and watershed condition improvements are expected to reduce erosion, compaction and resulting stream sedimentation and improve water quality conditions over time.

Water Temperature

There are minimal proposed vegetation treatments within stream management zones within the Bradshaw Vegetation Management Project area 6th-field HUC watersheds that overlap with the Hassayampa Project. Project design features for the Bradshaw Vegetation Management Project include that stream management zones be identified and evaluations and corresponding conservation measures will be developed prior to implementation for the perennial, interrupted and intermittent stream drainage channels.

For prescribed fire in Bradshaw Vegetation Management Project, broadcast burns would not be ignited within the stream management zones, but low severity fire would be allowed to back into the stream management zones without suppression. Firelines for prescribed burn control would not be constructed within stream management zones. Pile burns could be performed within stream management zones but not within 25 feet of the outer edge of the stream channel or floodplain.

Mechanical thinning and mechanized fuel treatments in Bradshaw Vegetation Management Project would be allowed within the outer portions of some stream management zones, if slopes are less than 20 percent. Riparian woody vegetation (willow, cottonwood, alder, sycamore, etc.) would not be targeted for cutting or removal.

Past, present, and reasonably foreseeable project activities within the Bradshaw Vegetation Management Project area 6th-field HUC watersheds that overlap with the Hassayampa Project are not expected to change water temperature regimes because of the small amount of area treated and with implementation of resource protection measures identified in appendix A of the Bradshaw Vegetation Management Environmental Assessment.

Cumulative Effects to Aquatic Species

Gila Trout and Verde Rim Springsnail

Cumulative effects area for the species analysis is the upper Grapevine Creek drainage in the project area. Past, present, and reasonably foreseeable actions that contribute to the cumulative effects of this project include the following.

- Recreational activities occur within the Grapevine Botanical Area. Implementation of best management practices would minimize impacts to Gila trout and their habitat.
- No livestock grazing occurs within the Grapevine Botanical Area.
- No mining occurs within the Grapevine Botanical Area.

This alternative combined with the above activities would not change the existing species population and habitat conditions in Grapevine Creek. Therefore, there would be no cumulative effects to this species.

Desert Sucker and Lowland Leopard Frog

Cumulative effects area for the species analysis are the Hassayampa River, Milk Creek, Blind Indian Creek, and Big Bug Creek 6th-field HUC watersheds in the project area. Past, present, and reasonably foreseeable actions that contribute to the cumulative effects of this project include the following.

- Recreational activities occur within the various 6th-field HUC watersheds. All lands administered by the Forest Service have best management practices and Forest Plan standards and guidelines related to recreation uses, especially roads and trails, which would retain/improve watershed conditions on the forests and minimize impacts to aquatic species and their habitats.

- Livestock grazing occurs within the various 6th-field HUC watersheds and also along stream zones. All lands administered by the Forest Service have grazing management plans that provide for vegetation, soil, and water quantity/quality health, which minimize impacts to aquatic species and their habitat.
- Mining occurs along stream zones within the various 6th-field HUC watersheds. All mining activities on forestlands have site specific best management practices and reclamation plans to mitigate potential adverse effects to natural resources associated with mining.

This alternative combined with the above activities would not change the existing species population and habitat conditions in the project area. Therefore, there would be no cumulative effects to this species.

Summary of Effects

Table 9. Summary comparison of environmental effects to Aquatic Resources

Resource Element	Indicator Measure	Alternative 1	Alternative 2
Aquatic Habitat Quantity and Water Quality	Sediment delivery	There would be no actions taken under this alternative to improve the health of the fire-adapted ecosystem through prescribed fire and fuels reduction. Therefore, no direct or indirect effects to aquatic resources in the project area would occur. However, the risk of a large wildfire event would increase overtime. Large fire events on the landscape are expected to produce soil loss given the high percentage of the area with moderate to severe erosion hazard. This would result in increased sedimentation to streams with likely impacts to aquatic resources being a decrease in habitat quantity (e.g., filling in of riffles and pools) and quality due to reduction of macroinvertebrate production. Impacts may last more than 10 years.	A total of about 231,000 acres of prescribed fire and about 90,000 acres of fuel reduction treatments would occur within the 6th-field HUC watersheds over the period of the project. Prescribed fire is expected to have short-term increased soil loss in treated areas because of the temporary loss of ground cover. The potential amount of sedimentation to streams would be reduced through implementation of resource protection measures. There may be short-term effects to aquatic resources but habitat quantity and water quality should be maintained within acceptable levels. Fuel reduction treatments most likely would have minimal soil loss because of the increase of ground cover implementation of resource protection measures.
Aquatic/ Riparian Habitat and Water Quality	Water temperature	No direct or indirect effects to aquatic/riparian resources in the project area would occur. However, the risk of a large wildfire event would increase overtime. Large fire events on the landscape could burn through riparian areas. This would results in loss of stream shading and increase in water temperatures.	A total of 3,367 acres (8% of stream management zones) proposed vegetation treatments within 100-foot of perennial/intermittent streams within select 6 th -field HUC watersheds. There would be no treating of facultative or obligate riparian tree species. Tree thinning within the stream management zones using various mechanical and hand methods would reduce tree densities and fuel loads to desired conditions. Overall, treatments are not expected to increase water temperatures because of the small amount of stream management zones being treated and the implementation of resource protection measures.

Table 10. Determination of effects for Federally listed species and Forest Service Region 3 Sensitive Species

Species	Species Status	Alternative 1 No Action	Alternative 2 Proposed Action
Gila trout	ESA Threatened	No Effect	May Affect, Not Likely to Adversely Affect
Desert sucker	FS Sensitive	No Effect	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability
Lowland leopard frog	FS Sensitive	No Effect	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability
Verde Rim springsnail	FS Sensitive	No Effect	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The no action alternative would not meet desired conditions in the Prescott Land and Resource Management Plan for ecosystem resilience to climate change to provide quality habitat to support recovery/conservation for federally listed and Forest Service sensitive species.

The proposed action of the Hassayampa Landscape Restoration Project would comply with the Prescott National Forest Plan standards for soil and hydrology resources, which would protect and/or benefit aquatic resources. The proposed vegetation and fuel treatments in each alternative are not expected to adversely affect soil or hydrology resources because of resource protection measures that would be implemented as part of the proposed action alternative.

Compliance with the Endangered Species Act would be completed for federally listed species in the project area. This project would not make irreversible or irretrievable commitments and the status quo would be maintained during the consultation process.

Other Agencies and Individuals Consulted

The scoping letter for the Hassayampa Project was sent to the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department for their comments to the proposed action related to wildlife species in the project area. Comments were received from both agencies to protect aquatic resources, particularly Gila trout in Grapevine Creek, from project activities.

References Cited

- Anderson, M. 2014. Grapevine Creek Gila trout activities September 2013–April 2014. Fisheries Branch, Arizona Game and Fish Department, Phoenix, AZ. 12 p.
- ADEQ 2015. 2012/2014 Status of Ambient Surface Water Quality in Arizona –Arizona’s Integrated 305(b) Assessment and 303(d) Listing Report.
- Arizona Game and Fish Department. 2002. Desert sucker (*Catostomus clarki*). Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 4 p.
- Arizona Game and Fish Department. 2003. Verde Rim springsnail (*Pyrgulopsis glandulosa*). Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 4 p.
- Arizona Game and Fish Department. 2006. Lowland leopard frog (*Rana yavapaiensis*). Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 10 p.
- Blanchette, G.E.; Sorensen, J.A. 2016. Verde Rim springsnail survey results 2009–2016. Nongame and Endangered Wildlife Program Technical Report 305, Arizona Game and Fish Department, Phoenix.
- Desert Fishes Team. 2004. Status of unlisted native fishes of the Gila River Basin, with recommendations for management. Report number 2.
- Elliot, W.J.; Miller, I.S.; Audin, L. Eds. 2010. Cumulative watershed effects of fuel management in the western United States. Gen. Tech. Rep. RMRS-GTR-231. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 299 p.
- Emmons, I.; Nowak, E. 2012. Prescott National Forest riparian herpetofauna surveys 2010–2012 draft final report. Report submitted to Prescott National Forest by Colorado Plateau Research Station, Northern Arizona University, Flagstaff.
- Gresswell, R.E. 1999. Fire and Aquatic Ecosystems in Forested Biomes of North America. Transactions of the American Fisheries Society, 128:2, 193-221. U.S.
- Parker, J. 2006. Post-wildfire sedimentation in Saguaro National Park, Rincon Mountain District, and effects on lowland leopard frog habitat: U.S. Geological Survey Scientific Investigations Report 2006-5235, 35 p.
- Pilliod, D.S., Bury, R.B., Hyde, E.J., Pearl, C.A., and P.S. Corn. 2003. Fire and amphibians in North America. Forest Ecology and Management 178 (2003) 163-181.
- Sorensen, J. 2017. Personal communication with Jeff Sorensen, Invertebrate Wildlife Program Manager, Arizona Game and Fish Department, Phoenix, AZ.
- Stephens, T. 2017, 2018. Personal communication with Tracy Stephens, Native Trout and Chub Coordinator, Arizona Game and Fish Department, Phoenix, AZ.

- USDA Forest Service. 1997. Environmental assessment for Grapevine Springs Botanical Area designation. Bradshaw Ranger District, Prescott National Forest.
- USDA Forest Service. 2015. Prescott National Forest Land and Resource Management Plan.
- USDA Forest Service. 2017. Region 3 Regional Forester's Sensitive Species.
https://www.fs.usda.gov/detail/r3/plants-animals/?cid=FSBDEV3_022105
- USDI Fish and Wildlife Service. 2003. Gila trout (*Oncorhynchus gilae*) recovery plan (third revision). Region 2, Albuquerque, NM.
- Voeltz, J.B.; Bettaso, R.H. 2003. 2003 Status of the Gila topminnow and desert pupfish in Arizona. Nongame and Endangered Wildlife Program Technical Report 226, Arizona Game and Fish Department, Phoenix.
- Zwartjes, P.W.; Cartron, J.E.; Stoleson, P.L.; [and others]. 2005. Assessment of native species and ungulate grazing in the Southwest: Terrestrial wildlife. General Technical Report RMRS-GTR-142, USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 74 p.

Appendix A: Resource Protection Measures

Hydrology and Watershed Resources – Relevant to Fisheries

A-3. Treatment footprints should integrate mosaic patterns that mimic cover and/or density levels identified in the Forest Plan PNVT descriptions. This would create vegetative age-class diversity, buffer accelerated soil loss, and mitigate accelerated runoff and sedimentation. For specific cover and structure values, the Prescott National Forest Terrestrial Ecological Unit Inventory (TEUI) and Ecological Classification would be used.

A-4. Burn severity prescriptions should correlate to Forest Plan desired conditions by PNVT. Strategies of applying high burn severity should be conducted in patchy, non-continuous patterns that are buffered with unburned vegetation or areas subjected to low-burn severity.

G-1. When developing implementation and treatment plans a streamside management zone (SMZ)^{2,3} map should be developed and used to help identify treatment strategies.

G-2. Retain a diversity of tree species and age classes in the SMZ. Keep enough mature trees to avoid potential regeneration problems.

G-3. Clearly designate vegetation to be treated in the SMZ, and maintain riparian vegetation within the SMZ.

G-4. Do not identify treating facultative or obligate riparian vegetation in the SMZ.

G-5. Leave sufficient vegetation to provide bank stabilization, shade, and a future source of large woody debris.

G-6. Avoid broadcast burning in the SMZ unless specifically identified as the proper management treatment. Minimize and avoid application of high and moderate burn severity in the SMZ.

G-10. Maintain sufficient ground cover within the SMZ to trap sediment before it enters any watercourse.

² The streamside management zone (SMZ) is an area or strip of land adjacent to a stream or other body of water where management practices are planned and implemented in a manner that protects water quality, aquatic wildlife and wildlife habitat. Trees and vegetation within the SMZ serve as a natural filter to keep sediment out of a stream, reduce soil erosion, and buffer the stream from damage caused by nearby management activities such as harvesting of timber, vegetation treatment, and road construction or prescribed burning. The SMZ is not a zone of exclusion where all activities are precluded, but because of the need to protect water quality and other values, the SMZ is an area where activities should be carefully managed.

³ A SMZ is also referred to as the aquatic management zone (AMZ). An AMZ is an administratively designated zone adjacent to stream channels and other waterbodies. Special management controls aimed at maintaining and improving water quality or other water- and riparian-dependent values, including groundwater-dependent ecosystems, should be applied in the delineated AMZ. The width of the AMZ is determined based on site-specific factors and local requirements. AMZ delineation may encompass the floodplain and riparian areas when present. AMZ designation can have synergistic benefits to other resources, such as maintaining and improving aquatic and riparian area-dependent resources, visual and aesthetic quality, wildlife habitat, and recreation opportunities. National BMPs for Water Quality Management on National Forest System Lands (2012).

H-1. All management treatments would be designed in a manner that minimizes soil disturbances and facilitates implementation of best management practices. Obtain a terrestrial ecosystem survey map for guidance of site-specific best management practices in applicable PNVTs, which corresponds with project level terrestrial ecosystem survey map units. Map units correspond with the Terrestrial Ecosystem Survey of the Prescott National Forest (2000). The terrestrial ecosystem survey includes potentials associated with climate, vegetation, and soils.

H-5. Prescribed fire planning measures on slopes 40 percent and greater would take steps to mitigate soil impacts and minimize accelerated erosion. Examples may include evaluating different ignition strategies, minimizing burn severity, creating larger unburned mosaics, back burning, and ensuring full consumption of ground cover does not occur.

H-7. If treatment slash is chipped, optimal wood chip depth is 1 to 2 inches and should not exceed 3 inches.

Appendix B: Federally Listed Plants and Animals (April 2016)

Scientific Name	Common Name	ESA Status ¹	Migratory Bird Status ²
Birds			
<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher	E	PIF
<i>Strix occidentalis lucida</i>	Mexican spotted owl	T	PIF
<i>Coccyzus americanus occidentalis</i>	Western yellow-billed cuckoo	T	BOCC/PIF
Fish			
<i>Gila intermedia</i>	Gila chub	E	
<i>Poeciliopsis occidentalis occidentalis</i>	Gila topminnow	E	
<i>Ptychocheilus lucius</i>	Colorado pikeminnow	EXPN	
<i>Xyrauchen texanus</i>	Razorback sucker	E	
<i>Meda fulgida</i>	Spikedace	E	
<i>Oncorhynchus gilae</i>	Gila trout	T	
<i>Tiaroga cobitis</i>	Loach minnow	E	
Reptiles			
<i>Thamnophis eques megalops</i>	Northern Mexican gartersnake	T	
<i>Thamnophis rufipunctatus</i>	Narrow-headed gartersnake	T	
Critical Habitats			
<i>Strix occidentalis lucida</i>	Mexican spotted owl		
<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher		
<i>Gila intermedia</i>	Gila chub		
<i>Meda fulgida</i>	Spikedace		
<i>Xyrauchen texanus</i>	Razorback sucker		
<i>Tiaroga cobitis</i>	Loach minnow		
<i>Thamnophis eques megalop</i>	Northern Mexican gartersnake, (proposed)		
<i>Thamnophis rufipunctatus</i>	Narrow-headed gartersnake, (proposed)		
<i>Coccyzus americanus occidentalis</i>	Western yellow-billed cuckoo, (proposed)		

¹ Status definitions:

E = Listed endangered under the Endangered Species Act: Any species that is in danger of extinction throughout all or a significant portion of its range (appendix A).

T = Listed threatened under the Endangered Species Act: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (appendix A).

PT = Proposed threatened under the Endangered Species Act.

C = Candidates are those species for which the U.S. Fish and Wildlife Service has enough information on file to propose listing as threatened or endangered, but listing has been precluded by other agency priorities.

EXPN = Experimental population, non-essential.

² Migratory Bird Status definitions:

BCC = Birds of Conservation Concern, U.S. Fish and Wildlife National Priority List.

PIF = Partners in Flight priority bird species (Latta 1999).

Federally listed species on the USFWS website for Yavapai County that do not occur on the Prescott National Forest:

Arizona cliffrose (*Purshia subintegra*), Endangered

Page springsnail (*Pyrgulopsis morrisoni*), Candidate

Black-footed ferret (*Mustela nigripes*), Endangered

California condor (*Gymnogyps californianus*), Endangered

Headwater chub (*Gila nigra*), Proposed Threatened

Chiricahua leopard frog (*Lithobates chiricahuensis*), Threatened

Desert pupfish (*Cyprinodon macularis*), Endangered

Appendix C: Regional Forester's Sensitive Animal and Plant Species (April 2016)

Scientific Name	Common Name	Migratory Bird Status ¹
Birds		
<i>Accipiter gentilis</i>	Northern goshawk	BOCC, PIF
<i>Falco peregrinus</i>	American peregrine falcon	BOCC
<i>Haliaeetus leucocephalus</i>	Bald eagle	BOCC
Reptiles		
<i>Gopherus morafkai</i>	Sonoran desert tortoise	
Mammals		
<i>Lasiurus blossevillei</i>	Western red bat	
<i>Corynorhinus townsendii pallescens</i>	Pale Townsend's big-eared bat	
Amphibians and Aquatic Reptiles		
<i>Lithobates (Rana) yavapaiensis</i>	Lowland leopard frog	
Fish		
<i>Catostomus clarki</i>	Desert sucker	
<i>Catostomus insignis</i>	Sonora sucker	
<i>Gila robusta</i>	Roundtail chub	
Snails		
<i>Pyrgulopsis glandulosa</i>	Verde Rim springsnail	
<i>Pyrgulopsis sila</i>	Brown springsnail	
Insects		
<i>Wormaldia plana</i>	A caddis fly	
Plants		
<i>Agave delamateri</i>	Tonto Basin agave	
<i>Agave phillipsiana</i>	Phillips agave	
<i>Arenaria abherrans</i>	Mt. Dellenbaugh sandwort	
<i>Asclepias incialis</i> ssp. <i>uncialis</i>	Greene milkweed	
<i>Carex ultra</i> (=C.spissa var. <i>ultra</i>)	Cochise sedge	
<i>Desmodium metcalfei</i>	Metcalfe's tick-trefoil	
<i>Erigeron saxatilis</i>	Rock fleabane	
<i>Eriogonum ericifolium</i> var. <i>ericifolium</i>	Heathleaf wild buckwheat	
<i>Eriogonum ripleyi</i>	Ripley wild buckwheat	
<i>Hedeoma diffusum</i>	Flagstaff pennyroyal	
<i>Heuchera eastwoodiae</i>	Eastwood alum root	
<i>Lupinus latifolius</i> spp. <i>Leucanthus</i>	Broad-leafed lupine	
<i>Pediomelum verdiensis</i>	Verde breadroot	
<i>Penstemon nudiflorus</i>	Flagstaff beardtongue	
<i>Phlox amabilis</i>	Arizona phlox	
<i>Polygala rusbyi</i>	Hualapai milkwort	
<i>Salvia doriai</i> spp. <i>mearnsii</i>	Mearns sage	

¹ Status definitions:

BOCC = Birds of Conservation Concern—U.S. Fish and Wildlife Service National Priority List.

PIF = Partners in Flight priority bird species (Latta 1999).

Appendix D: Species Excluded from Detailed Analysis

The following federally listed and Forest Service Sensitive Species are not known to occur within or near the project area, and populations would not be affected by the proposed action. For this reason, they are not included in the previous detailed analysis. Species background information is the known distribution or habitat association for the species.

Species Common Name Scientific Name	Status ¹	Species Background Information	Project Information
Razorback Sucker <i>Xyrauchen texanus</i>	E	In the lower Colorado River Basin, populations isolated to lakes Mohave, Mead, and the lower Colorado River below Havasu. Populations have been reintroduced into the Verde River. Found in backwaters, flooded bottomlands, pools, side channels and other slower moving habitats.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Razorback Sucker Critical Habitat		Critical habitat is designated for 124 miles of the Verde River from Perkinsville downstream to Horseshoe Dam.	No designated critical habitat occurs within the project area or would be impacted by this project.
Gila Chub <i>Gila intermedia</i>	E	Gila chub have been recorded in approximately 30 rivers, streams, and spring-fed tributaries throughout the Gila River Basin in New Mexico, northern Sonora, Mexico, and central and southeastern Arizona. Gila chub and designated critical habitat occur in Sycamore Creek, Little Sycamore Creek, and Indian Creek in the Agua Fria River drainage on the Prescott National Forest. They also occur in Williamson Valley Wash downstream of forestlands in the Verde River drainage. Gila chub commonly inhabit pools in smaller streams, cienegas, and artificial impoundments throughout its range.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Gila Chub Critical Habitat		Designated critical habitat occurs in Sycamore Creek, Little Sycamore Creek, and Indian Creek in the Agua Fria River drainage on the Prescott National Forest.	No designated critical habitat occurs within the project area or would be impacted by this project.
Colorado Pikeminnow <i>Ptychocheilus lucius</i>	E, EXPN	Currently, natural populations are restricted to upper Colorado River Basin of Colorado, Utah, New Mexico, and Wyoming. Extirpated from lower Colorado River by the 1970s. Experimental nonessential populations have been reintroduced into the Verde and Salt rivers in Arizona. This species occurs in rivers with high silt content, warm water, turbulence, and variable flow by season.	Neither the species nor its habitat occur within the project area or would be impacted by this project.

Species Common Name Scientific Name	Status ¹	Species Background Information	Project Information
Gila Topminnow <i>Poeciliopsis occidentalis occidentalis</i>	E	Currently occurs in the Gila River drainage, Arizona, particularly in the upper Santa Cruz River, Sonoita and Cienega creeks, and the middle Gila River; and in the Rio Sonora, Rio de la Concepcion, and Santa Cruz River. There are no extant populations on the Forest from introductions made in the early 1980s. Occurs in small streams, springs, and cienegas below 1,350 m (4,500 ft) elevation, primarily in shallow areas with aquatic vegetation and debris for cover.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Spikedace <i>Meda fulgida</i>	E	Currently occurs in portions of the upper Gila River (NM), middle Gila River, lower San Pedro River, Aravaipa Creek, Eagle Creek, Fossil Creek, and upper Verde River (AZ). In the upper Verde River, spikedace have become rare to nonexistent. Found in moderate to large perennial streams, where it inhabits slow to moderate velocity waters over gravel and rubble substrates.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Spikedace Critical Habitat		Critical habitat is designated along 107 miles of the Verde River from the confluence with Fossil Creek upstream to Sullivan Dam.	No critical habitat occurs within the project area or would be impacted by this project.
Loach Minnow <i>Tiaroga cobitis</i>	E	Currently occurs in portions of the upper Gila River (NM), San Francisco River, Blue River, Aravaipa Creek, Eagle Creek, White River, Black River, Fossil Creek (AZ). They are extirpated from the Verde River. Found in moderate to swift flow velocities with shallow water with gravel and cobble substrates.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Loach Minnow Critical Habitat		Critical habitat is designated along 74 miles of the Verde River from the confluence with Beaver Creek upstream to Sullivan Dam.	No critical habitat occurs within the project area or would be impacted by this project.
Roundtail Chub <i>Gila robusta</i>	C/S	In the lower Colorado River Basin, occurs in the Little Colorado, Bill Williams, Gila, Salt, and Verde rivers and most of their perennial tributaries of AZ and NM. Commonly found in pool habitats and near instream cover. Known only in the Verde River on the Prescott National Forest.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Sonora Sucker <i>Catostomus insignis</i>	S	Occurs in Gila and Bill Williams river basins of AZ and NM, and in Gila basin of northern Sonora, Mexico. Commonly found in pool habitats. Known only in the Verde River on the Prescott National Forest.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Northern Mexican Gartersnake <i>Thamnophis eques megalops</i>	T	Occurs primarily in permanent marshes and streams at middle elevations in central, south-central and southeastern Arizona. This species is known from along the Verde River.	Neither the species nor its habitat occur within the project area or would be impacted by this project.

Species Common Name Scientific Name	Status ¹	Species Background Information	Project Information
Narrow-headed Garter Snake <i>Thamnophis rufipunctatus</i>	T	Occurs from central Arizona to western New Mexico and south to central and western Chihuahua and northern and western Durango, Mexico. In Arizona, known primarily from streams draining the Mogollon Rim and the White Mountains. Highly aquatic species, associated with riffle/pool complexes of cool, clear, rocky mountain streams. Known from along the Verde River and on Oak Creek.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
Brown Springsnail <i>Pyrgulopsis sila</i>	S	<i>Total range:</i> Endemic to Brown Spring, Yavapai County, northwestern Arizona. Spring is located on private lands. Known only on Prescott National Forest.	Neither the species nor its habitat occur within the project area or would be impacted by this project.
A Caddisfly <i>Wormaldia plana</i>	S	A Caribbean genus, <i>Wormaldia</i> is more or less restricted to the cooler spring-fed streams in mountainous regions of middle America (Flint 1968). This species was originally described from Chiapas, Mexico; but was recently found in Arizona from Gila to Yavapai Counties (Gila County: Line Fossil Creek, Fossil Creek; Yavapai County: Beaver Creek, below outlet of Montezuma Well, unnamed stream at Ward Ranch) (Munoz-Quesada and Holzanthal 2008). Heritage Data Management System will need to obtain report to help identify locations found in AZ.	Neither the species nor its habitat occur within the project area or would be impacted by this project.

¹ Status Definitions:

E = Listed endangered under the Endangered Species Act: Any species that is in danger of extinction throughout all or a significant portion of its range (appendix A).

T = Listed threatened under the Endangered Species Act: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (appendix A).

PT = Proposed threatened under the Endangered Species Act.

C = Candidates are those species for which the U.S. Fish and Wildlife Service has enough information on file to propose listing as threatened or endangered, but listing has been precluded by other agency priorities.

EXPN = Experimental population, non-essential

S = Those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by (1) significant current or predicted downward trends in population numbers or density, (2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.